CLAIMS

We claim:

1. An interconnection for interconnecting microelectronic chips with optical wires, wherein said optical wires are bonded onto said microelectronic chips and optically connected therewith.

2. The interconnection according to Claim 1, comprising a segment of an optical fiber, said segment having two opposite ends, said ends being a first end and a second end, said ends being attached to said microelectronic chips by means of terminations, said terminations being disposed on a substrate material having a first side and a second side.

3. The interconnection according to Claim 2, said terminations being optically coupled to said optical fiber and said terminations being further electrically coupled to said microelectronic chips.

4. The interconnection according to Claim 2, wherein said terminations comprise a laser chiplet and a photodetector chiplet, said first end being connected to said laser chiplet and said second end being connected to said photodetector

chiplet.

5. The interconnection according to Claim 2, wherein said optical fiber is having a numerical aperture of at least about 0.35.

6. The interconnection according to Claim 2, further comprising a groove and a mirror.

7. The interconnection according to Claim 2, wherein said optical fiber is disposed within a groove.

8. The interconnection according to Claim 3, wherein said terminations are vertically coupled devices.

9. The interconnection according to Claim 3, wherein said terminations further comprise solder bumps and gold/gold compression bonds.

10. The interconnection according to Claim 4, wherein an optical path is established so that light travels from said laser chiplet through said substrate material to said photodetector chiplet.

11. The interconnection according to Claim 4, wherein said terminations are having a size of not more than about 250 micrometers in width and not more than about 250 micrometers in length.

12. The interconnection according to Claim 4, wherein said laser chiplet comprises a vertical-cavity surface emitting laser.

13. The interconnection according to Claim 4, wherein said photodetector chiplet comprises a PIN photodiode detector or a metal-silicon-metal photodetector.

14. The interconnection according to Claim 6, wherein said mirror is disposed on said second side of said terminations.

15. The interconnection according to Claim 6, wherein said second side of said substrate is a (100) crystallographic surface, said groove is aligned along (01$\bar{1}$) crystallographic direction and said mirror is aligned along (0$\bar{1}\bar{1}$) crystallographic direction.

16. The interconnection according to Claim 7, wherein said groove is V-shaped.

17. The interconnection according to Claim 9, wherein said electrical coupling of said terminations to said microelectronic chips is achieved with two or more of said solder bumps or said compression bonds.

18. The interconnection according to Claim 10, wherein said substrate material comprises gallium arsenide or indium phosphide.

19. The interconnection according to Claim 10, wherein said substrate material has a Zinc-blende crystallographic structure.

20. The interconnection according to Claim 12, wherein said vertical-cavity surface emitting laser is fabricated on a gallium arsenide substrate.

21. The interconnection according to Claim 12, wherein said vertical-cavity surface emitting laser is fabricated on a indium phosphide substrate.

22. The interconnection according to Claim 12, wherein said vertical-cavity surface emitting laser is disposed on said first side of said terminations.

23. The interconnection according to Claim 13, wherein said photodetector chiplets are disposed on said first side of said terminations.

24. The interconnection according to Claim 13, wherein said photodetector chiplets are fabricated on a substrate material, said substrate material comprising gallium arsenide or indium phosphide.

25. The interconnection according to Claim 16, wherein said groove is disposed on said second side of said termination.

26. The interconnection according to Claim 20, wherein said vertical-cavity surface emitting laser emits at a wavelength selected from a group of wavelengths, said group comprising wavelengths of about 980 nanometers or about 1300 nanometers.

27. The interconnection according to Claim 21, wherein said vertical-cavity surface emitting laser emits at a wavelength selected from a group of wavelengths, said group comprising wavelengths of about 1300 nanometers or about 1550 nanometers.

28. The interconnection according to Claim 24, wherein said photodetector chiplets are sensitive within a range of wavelengths between about 980 nanometers and about 1550 nanometers.

29. A method for fabricating an interconnection for interconnecting microelectronic chips with optical wires, said method comprising steps of:

(a) on a first side of a substrate material, having said first side and a second side, fabricating a termination;

(b) thinning and polishing said second side of said substrate;

(c) forming and patterning a "T" shaped opening on said second side of said substrate;

(d) aligning said "T" formed on said second side of said substrate with termination previously formed on said first side of said substrate;

(e) forming a mirror and a V-shaped groove on said second side of said substrate;

(f) aligning said mirror and said V-shaped groove;

(g) inserting an optical fiber into V-shaped groove; and

(h) attaching said optical fiber to said microelectronic chip.

30. The method according to Claim 29, wherein said substrate material comprises gallium arsenide or indium phosphide.

31. The method according to Claim 29, wherein said termination comprises a laser chiplet and a photodetector chiplet.

32. The method according to Claim 29, wherein said step of fabricating of said termination further comprises sub-steps of:

(a) epitaxially growing an etch-stop layer on said first side of said substrate material; and

(b) epitaxially growing said laser and photodetector unit.

33. The method according to Claim 29, wherein said step of forming and patterning a "T" shaped opening further comprises sub-steps of:

(a) depositing a film of silicon nitride on said second side of said substrate;

(b) photolithographically patterning said "T" shaped openings said film of silicon nitride; and

(c) etching said film of silicon nitride.

34. The method according to Claim 29, wherein said mirror and said V-shaped groove on said second side of said substrate are

formed by wet-chemical etching.

35. The method according to Claim 29, wherein said mirror and said V-shaped groove on said second side of said substrate are formed by wet-chemical etching, said substrate material comprising gallium arsenide.

36. The method according to Claim 29, wherein said optical fiber is having a numerical aperture of about 0.4, a cladding diameter of between about 125 micrometers and about 200 micrometers, and a core diameter of at least about 50 micrometers.

37. The method according to Claim 31, wherein said laser chiplet comprises a vertical-cavity surface emitting laser.

38. The method according to Claim 31, wherein said photodetector chiplet comprises a PIN photodetector and a metal-silicon-metal photodetector.

39. The method according to Claim 33, wherein said step of said etching comprises wet etching or dry etching.

40. The method according to Claim 34, wherein said wet-chemical

etching further comprises using an etchant solution comprised of about 2% solution of bromine in methanol.

41. The method according to Claim 35, wherein said wet-chemical etching further comprises using an etchant solution comprised of a mixture of hydrogen peroxide and hydrochloric acid.